BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 2 JANUARY 1954 PART 5

NEW YEAR MESSAGE FROM THE PRESIDENT

The New Year offers me an opportunity, which I cannot miss, of sending to you my most sincere good wishes and of expressing the hope that the year ahead may be a very happy one for you all.

I entered on my period of office with some qualms. These, however, have proved quite unnecessary, and from all of you I have experienced a kindness which has cloaked all my shortcomings. This store of friendship is an asset, imponderable perhaps, but one none the less of which the Institute may properly be proud.

LONDON.
DECEMBER, 1953.

J. C. Thompson

INSTITUTE NEWS

Joint Spring Meeting with the Société Française de Métallurgie

London and Provincial Centres, 26 April–4 May 1954

As previously announced, by invitation of the Council the Société Française de Métallurgie will hold a Joint Spring Meeting with the Institute of Metals in London from Monday to Friday, 26–30 April, with extension tours in the London area and the Provinces lasting until Tuesday, 4 May 1954, inclusive.

On two occasions members of the Institute of Metals have been most generously entertained in France at Autumn Meetings of the Institute, by invitation of the Société and the French metallurgical and engineering industries, and members of the Institute of Metals will agree that the time is overdue when they should have the opportunity to return this hospitality.

The invitation issued to members of the Société is intended to include all its members resident in countries other than the United Kingdom. As the Société Française de Métallurgie

covers both ferrous and non-ferrous metallurgy, the Council is inviting all members of the Iron and Steel Institute to participate in this Joint Spring Meeting on the same basis as members of the Institute of Metals, and it hopes that there will be a very large attendance of members of both Institutes to welcome its guests.

In connection with the meeting, a programme of papers and/or subjects for discussion on ferrous metallurgy is being arranged in co-operation with the Iron and Steel Institute.

The general lines of the programme of the meeting are given below. The full programme will be printed in the February issue of the *Bulletin*, and all members resident in Europe will receive a separate copy, with a reply form to be completed by those who intend to be present.

A " Who's Who ", giving particulars of those who are, in any way, attending the meeting will be printed and given to all those concerned by Industrial Newspapers, Ltd. The Secretary of the Institute would, therefore, be glad if members who hope to be present will notify him to that effect at the earliest possible moment, so that a form may be sent to them for completion in connection with the " Who's Who ". The Secretary will also be glad if those who expect to take tickets for the Banquet and Dance, at which the members of the Société will be the guests of the Institute, will (without obligation) advise him as early as possible, stating the probable number of their parties. Up to 1000 persons can dine and dance in the Great Room of Grosvenor House, so it is hoped that members of the Institute of Metals and the Iron and Steel Institute, with their personal guests, will be present in large numbers.

The Annual General Meeting, and all scientific and technical sessions (except the May Lecture), will be held at Church House, Westminster.

PROVISIONAL PROGRAMME

Sunday, 25 April

Members and ladies of the Société Française de Métallurgie arrive in London.

Monday, 26 April

Morn.—Registration of members and ladies of the Société.

Aft.—Coach tour of London by members and ladies of the Société.

Visits to works and laboratories by members of the Société.

6.30 p.m.—Opening Ceremony of the meeting at the Royal Institution. Welcome to members of the Société on behalf of the Institute of Metals and British Science.

7.0 p.m.—May Lecture, by Professor L. F. Bates, F.R.S., on magnetic characteristics of metals.

8.30 p.m.—Council Dinner in honour of the May Lecturer.

Tuesday, 27 April

Morn.—Registration of members, &c.

10.0 a.m.—Annual General Meeting of the Institute of Metals.

Presentation of a Presidential Badge to the Institute, by the Directors of Johnson, Matthey and Co., Ltd.

Induction of New President.

Presentation of Medals and Students' Essay Prizes.

Presidential Address, by Dr. S. F. Dorey, C.B.E., F.R.S.

12.0 noon.—Cocktail party, given for members and ladies of the Société.

Programme " A "

Aft.—Visits for members and ladies of the Société.

Programme " B "

Scientific Session. Discussion of (1) Paper No. 1495 and (2) jointly, Paper No. 1498 and a paper on brittleness in Al–Mg–Si alloys, to be published in the April issue of the *Journal*.

Evg.—Reception by Her Majesty's Government for members and ladies of the Société, to which representative members of the Institute and their ladies will also be invited.

Wednesday, 28 April

Morn.—Visits for members and ladies of the Société.

Scientific Session " A "

Symposium on " The Control of Quality in the Production of Wrought Non-Ferrous Metals and Alloys ". Part II.—" The Control of Quality in Working Operations ", based on papers to be published in the March issue of the *Journal* (to reach members early in March).

Scientific Session " B "

Discussion on " Precipitation-Hardening ", based on Papers Nos. 1440 and 1458 and three others to be published in the February issue of the *Journal*.

Scientific Session " C "

Discussion of papers on ferrous metallurgy, to be arranged in co-operation with the Iron and Steel Institute.

Aft.—Visits for members and ladies of the Société.

Scientific Session " A "

Symposium on " The Control of Quality in Working Operations " continued.

Scientific Session " B "

Discussion on " Creep ", based on Papers Nos. 1474, 1493, 1504, 1507, and 1512, and one by Chang and Grant to be published in the February issue of the *Journal*.

Evg.—Banquet and Dance in the Great Room of Grosvenor House, Park Lane, W.1, at which members and ladies of the Société Française de Métallurgie will be the guests of the Institute of Metals (tickets, price 35*s.* each, including, in addition to dinner and coffee, light refreshments served later in the evening). Dancing until 1.0 a.m.

Thursday, 29 April

All day.—Visits for members and ladies of the Société.

Morn. *Scientific Session " A "*

Informal Discussion on " Recovery and Recrystallization ", arranged by the Metal Physics Committee.

Scientific Session " B "

Discussion on " Continuous Casting ", based on a paper to be published in the *Journal*.

Discussion on " Molybdenum and Molybdenum Alloys and the Arc-Melting of Metals ", based on papers to be published in the *Journal*.

Aft.—Visits to works and laboratories for members of the Société, the Institute of Metals, and the Iron and Steel Institute.

Evg.—Reception by His Excellency the French Ambassador.

Friday, 30 April

All day.—Visits to (*a*) Cambridge or (*b*) a series of seven works or laboratories outside London, for members of the Société, the Institute of Metals, and the Iron and Steel Institute.

Saturday, 1 May

All day.—Tour for members and ladies of the Société (members of the Institute of Metals and of the Iron and Steel Institute and their ladies may also take part, if they desire).

Sunday, 2 May

Morn. & Aft.—Members and ladies of the Société free in London.

Evg.—Leave for Birmingham, Cambridge, Sheffield, or South Wales.

Monday and Tuesday, 3 and 4 May

All day.—Members and ladies of the Société pay visits to works and places of cultural and scenic interest in the areas of Birmingham, Cambridge, Sheffield, and South Wales, returning to France via London, on the morning of Wednesday, 5 May.

Election of Members

The following 2 Ordinary Members, 6 Junior Members, and 9 Student Members were elected on 23 November 1953 :

As Ordinary Members

OTTAR, Brynjulf, Research Director, Chemical and Metallurgical Division, Forsvarets Forskningsinstitutt, Biblioteket, Lillestrom, Norway.

PHILIPP, Berthold Ernest, Managing Director, Ambores, Ltd., 147 Victoria Street, London, S.W.1.

As Junior Members

BROWN, Floyd, D.Sc., Research Associate Professor of Metallurgy, Department of Engineering Research, North Carolina State College, Raleigh, N.C., U.S.A.

ENG, Kenneth, B.A., Metallurgist, British Welding Research Association, 29 Park Crescent, London, W.1.

HAYFIELD, Peter Charles Steele, B.Sc., A.Inst.P., Technical Officer, Research Department, Imperial Chemical Industries, Ltd., Metals Division, Kynoch Works, Witton, Birmingham 6.

KING, David Edward Charles, B.Sc., Assistant Metallurgist, Leach Plant, Nchanga Consolidated Copper Mines, Ltd., Chingola, Northern Rhodesia.

REEVE, Martin Rebekoff, B.Sc., Metallurgist, A/S Nordisk Aluminium-industri, Laboratoriet, Holmestrand, Norway.

ROBERTS, William Thompson, M.Sc., Ph.D., Technical Officer, Imperial Chemical Industries, Ltd., Metals Division, Kynoch Works, Witton, Birmingham 6.

As Student Members

BARTON, James Wilson, Student, Metallurgy Department, University of Liverpool.

CAIRNS, John Harper, Student, Department of Metallurgy, University of Manchester.

DAVIES, Gerald, Laboratory Assistant, National Smelting Co., Ltd., Swansea Vale Works, Llansamlet, Swansea.

DEW-HUGHES, David, Student, Department of Physical and Theoretical Metallurgy, University of Birmingham.

FRASER, Malcolm J., B.S., Rensselaer Polytechnic Institute, Troy, N.Y., U.S.A.

JONES, Derek Hugh, Laboratory Assistant, National Smelting Co., Ltd., Swansea Vale Works, Llansamlet, Swansea.

MITCHELL, Andrew Baird, Student, Department of Metallurgy, University of Liverpool.

MORRIS, Derek, Student, Department of Metallurgy, Royal School of Mines, London, S.W.7.

PYLE, Terence, Student of Metallurgy, 107 Lawton Moor Road, Northenden, Manchester.

Lattice-Spacing Units

In view of the confusion that exists between kX and Å. units, the Publication Committee has decided that in future the authors of papers in which new lattice-spacing determinations are reported shall be asked to include a statement making clear the units that are being used. Sentences of the following type are suggested :

Lattice spacings are expressed in kX units, using the wave-lengths from the Siegbahn Tables. (Alternatively, the actual wave-length of the radiation should be given.)

Lattice spacings are expressed in true Å. units, using a factor of 1·00202 to correct the wave-length in the Siegbahn Tables.

"Metallurgical Abstracts" Volumes Urgently Wanted

The Institute will pay £1 each for bound volumes, in good condition, of *Metallurgical Abstracts* 1940 (vol. 7), 1941 (vol. 8), 1942 (vol. 9), 1943 (vol. 10), 1945 (vol. 12).

The following monthly parts of the *Journal and Metallurgical Abstracts* are also urgently required, and the Institute will pay 7*s.* 6*d.* for each copy in good condition :

1940 : Feb., March, April, Nov.
1941 : July, Aug.
1942 : July, Oct.
1943 : May, Oct.
1945 : Feb., March, April, May.

Copies offered for sale should be addressed to the Secretary.

Members' Addresses Wanted

The Secretary has lost touch with the undermentioned members and would be glad to receive information regarding their present whereabouts.

Name.	*Last known address.*
ALEXANDER, T. A.	West Smethwick Metal Co., Oldbury Road, Smethwick, Staffs.
BRANTON, J. A.	621 St. Kilda Road, Melbourne, Australia.
METZGER, G. E.	Royal School of Mines, London.

PERSONAL NOTES

MR. B. B. ARGENT has obtained the degree of B.Met. with first-class Honours at Sheffield University and has been awarded a Mappin Medal in Metallurgy.

MR. N. D. BENSON has been appointed Mill Manager at the new factory of Imperial Chemical Industries, Ltd., Metals Division, at Kirkby, near Liverpool.

DR. F. P. BOWDEN has been elected a Member of Council of the Royal Society.

MR. J. D. BUNTON has been appointed Chief Metallurgist at the Bromsgrove and Darlaston works of Garringtons, Ltd.

MR. C. R. FAULKNER has been awarded the Ph.D. degree of Birmingham University.

MR. W. A. GARDNER has left the Royal School of Mines and is now a Research Metallurgist with Aluminium Laboratories, Ltd., Banbury.

MR. D. GILBEY has left the Royal School of Mines, having gained the B.Sc. and A.R.S.M., and has taken a position in the Gold Coast with Bibiani (1927), Ltd.

DR. S. L. HOYT has retired as Technical Adviser at Battelle Memorial Institute in order to engage in consulting practice.

MR. W. J. JACKSON has recently been awarded the M.Sc. (Eng.) degree of London University.

MR. D. C. G. LEES has left the Aluminium Development Association to join Aluminium Union, Ltd., as Development Engineer.

PROFESSOR G. LETENDRE has been elected a Vice-President of the Canadian Institute of Mining and Metallurgy.

MR. M. LITTMANN has resigned his position as Managing Director of Metro-Cutanit, Ltd., and has established a consulting practice at 4 Bryanston House, Dorset Street, London, W.1.

MR. J. E. MCLENNAN has returned to Australia, where his address will be c/o Metallurgy Section, Aeronautical Research Laboratories, Fisherman's Bend, Victoria.

PROFESSOR R. F. MEHL has been awarded the Francis J. Clamer Medal of the Franklin Institute for his contributions in the fields of metallurgy and metallography.

MR. A. METCALFE has left the Deloro Smelting and Refining Co., Ltd., to take a post as Research Metallurgist at the Armour Research Foundation of the Illinois Institute of Technology.

PROFESSOR N. F. MOTT has been awarded a Royal Medal for his eminent work in the field of quantum theory and particularly in the theory of metals. He has recently been appointed to the Cavendish Chair of Experimental Physics at Cambridge University.

MR. P. R. POMEROY has left the British Non-Ferrous Metals Research Association, and joined the Research Department of Imperial Chemical Industries, Ltd., Metals Division.

MR. J. T. RICHARDS, who was formerly with the Beryllium Corporation, has recently been appointed President and Chief Engineer of Penn Precision Products, Inc., Reading, Pa., producers of precision-rolled beryllium copper strip.

DR. C. SYKES has been elected a Member of Council of the Royal Society.

MR. R. TATE has left the employ of the Defence Research Board of Canada and has taken the post of Metallurgist with Trans-Canada Airlines, Winnipeg.

PROFESSOR A. B. WINTERBOTTOM is returning to the Norges Tekniske Høgskole, Trondheim, Norway, from Pakistan.

LETTERS TO THE EDITOR

Shear along Slip Planes in Zinc Single Crystals

In an investigation of slip in zinc single crystals, the slip displacement has been measured directly, using the method of multiple-beam interferometry.[1] The crystals were grown from the melt, polished electrolytically, and deformed in tension at room temperature.

The results obtained are in agreement with the qualitative conclusion of Andrade and Roscoe [2] that in hexagonal metals the slip displacement increases with increasing macroscopic strain. Fig. 1 shows that the shear increases with glide,

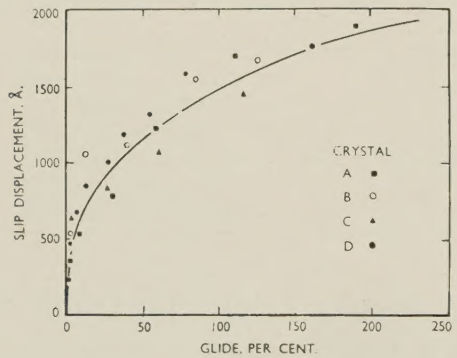


FIG. 1.—Variation of Slip Displacement with Glide.

reaching a maximum " saturation " value of 2000 Å. at large glides. In Fig. 2, the slip displacement is plotted against resolved shear stress. This was found to be a linear relationship, showing that the hardening law in the individual slip band is linear. As the values of the slip displacement given in Figs. 1 and 2 correspond to the most prominent slip lines, Fig. 2 gives the maximum coefficient of hardening in the slip plane. This value was found to be $27{\cdot}5 \times 10^{11}$ dyne/cm.^{3}, which is of the same order as the estimated value suggested by Cottrell.[3]

Within the range of diameters and orientations of the four

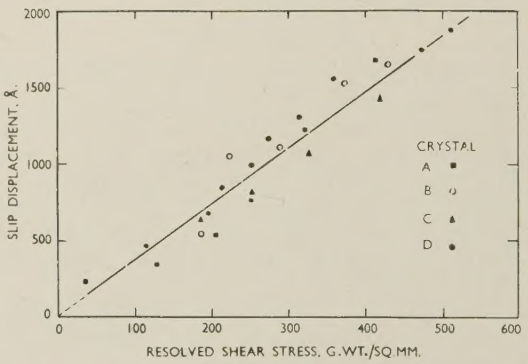


FIG. 2.—Variation of Slip Displacement with Resolved Shear Stress.

crystals examined, the above behaviour appears to be independent of both these factors.

This work is now being extended to investigate other factors, such as surface effects, time in creep experiments, and temperature of deformation.

A. H. ABDOU

Department of Metallurgy,
Sir John Cass College,
London, E.C.3.

REFERENCES

1. S. Tolansky, " Multiple-Beam Interferometry of Surfaces and Films ". Oxford: **1948** (Clarendon Press).
2. E. N. da C. Andrade and R. Roscoe, *Proc. Phys. Soc.*, 1937, **49**, 152.
3. A. H. Cottrell, " Dislocations and Plastic Flow in Crystals ", p .158. **1953**: Oxford (Clarendon Press).

Lattice-Parameter Measurements and the Rate of Oxidation of Alloys

X-ray-diffraction photographs have been used for the identification of the oxides formed on the surface of metals and alloys undergoing oxidation at high temperatures. Thickening of scale is accompanied by increasing intensity of the diffraction lines due to the oxide phases and decreasing intensity of the pattern of the underlying metal. This effect gives a qualitative measure of the rate of oxidation. A more quantitative measure may sometimes be obtainable with certain alloys by lattice-parameter measurements of the underlying alloy, (and sometimes NiO) have been observed on these alloys, but Cr_2O_3 usually predominates. Horn [2] has shown that the oxidation of alloys of this type follows a typical parabolic law.[3-5] The increase in weight, or the weight of oxide formed, is thus proportional to the square root of the time of oxidation at a given temperature. Hence, the decrease in lattice parameter of the nickel–chromium alloy may be expected to vary with the square root of the time.

Fig. 1 shows the lattice parameters of seven different qualities of nickel–chromium electrical-resistance wire plotted against the square root of the time. The alloys were tested in a standard Bash and Harsch life-test apparatus,[6] in which the

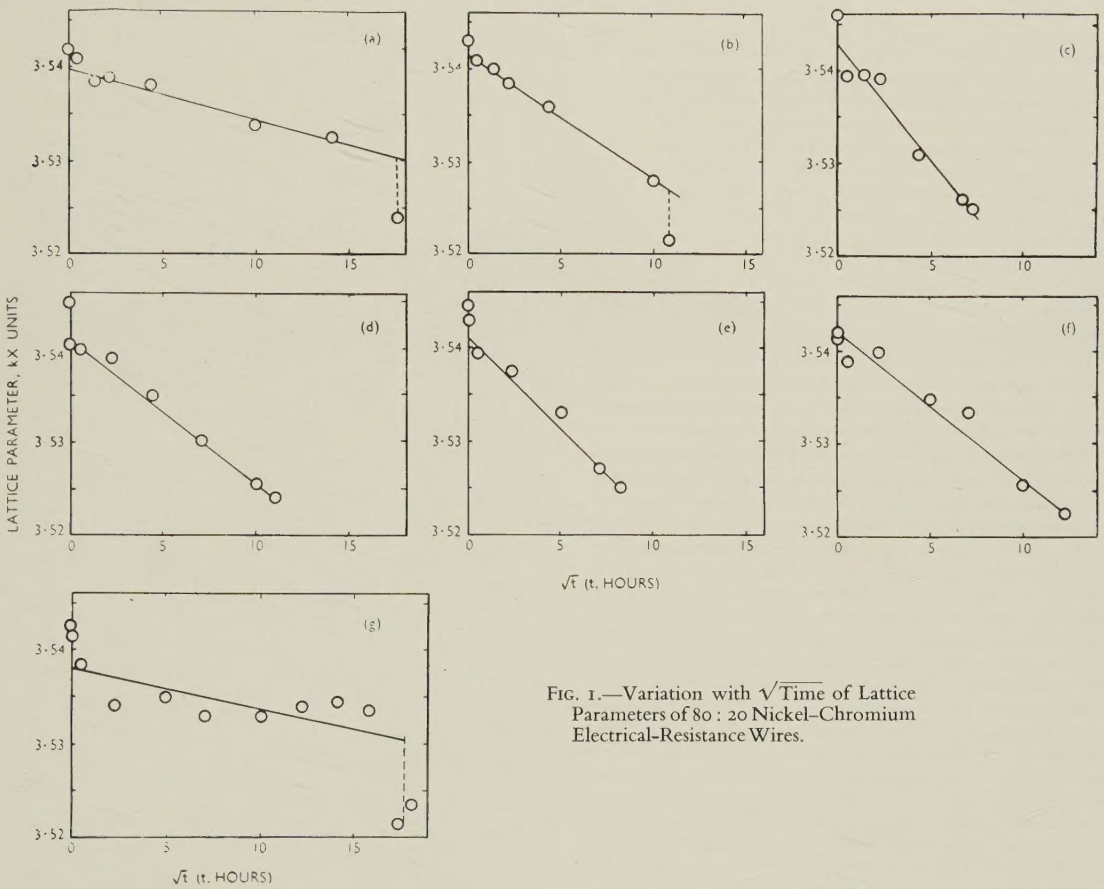
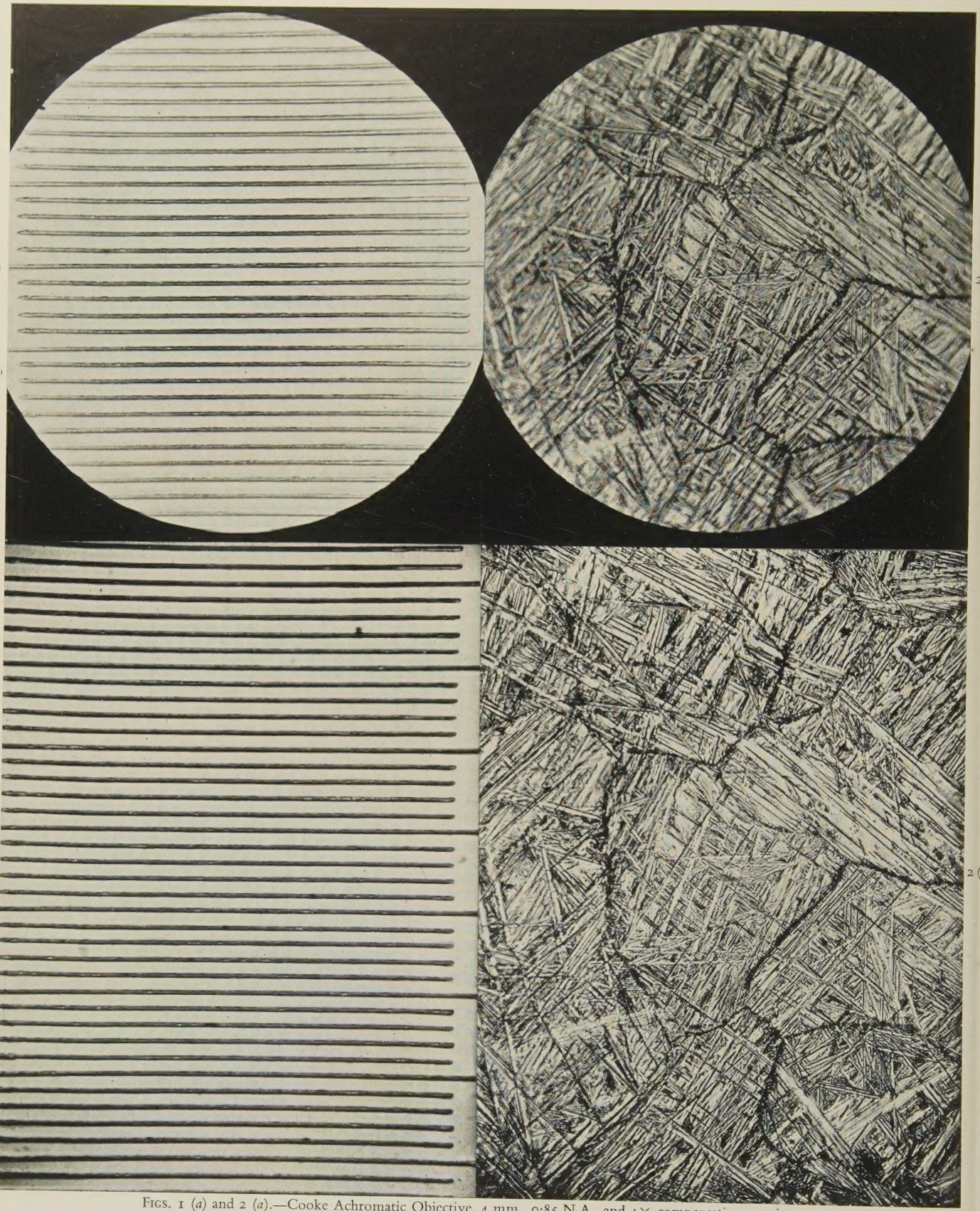


FIG. 1.—Variation with $\sqrt{\text{Time}}$ of Lattice Parameters of 80 : 20 Nickel–Chromium Electrical-Resistance Wires.

provided that the oxidation is selective and that there is a sufficient change of lattice parameter with composition. It has proved possible to examine 80 : 20 nickel–chromium electrical-resistance alloys in this way, and the results are noted here.

These nickel–chromium alloys are particularly suitable, since there is quite a marked change in lattice parameter as oxidation proceeds. Clearly, if oxidation involved only the formation of Cr_2O_3, the extent of oxidation as measured by, say, the increased total weight of metal + oxide, would be proportional to the amount of chromium removed from the metal lattice, which, in its turn, would lead to a fall in lattice parameter proportional to this loss of chromium. The lattice-parameter/composition relationship is approximately linear.[1] Alternatively, if the oxidation resulted entirely in the formation of the spinel $NiCr_2O_4$, there would still be a net decrease in the chromium content of the alloy. Both oxides wire is subjected to 2-min. periods of heating in air, alternating with periods of 2 min. when the current is cut off. The temperature of test was 1150° C. Special arrangements were made to obtain a series of samples at intervals for lattice-parameter measurements. The expected relationship was generally observed. The lattice-parameter measurements, therefore, give a key to the behaviour of the alloys. The slopes of the lines give the rates of oxidation and are a quantitative measure of the relative merits of different wires.

It will be noticed that in the seven cases illustrated in Fig. 1, only one (*g*) is doubtful. In the other six cases the points nearly all lie within the limits of experimental error on the straight lines shown. In some cases there is a sudden decrease in parameter accompanying failure at the end of the life test. There may also be a drop at the beginning of the test. A point of further interest is that the lattice parameter after failure at the end of test has, in each case, reached approximately the



Figs. 1 (*a*) and 2 (*a*).—Cooke Achromatic Objective, 4 mm., 0·85 N.A., and 4× compensating eyepiece.
Figs. 1 (*b*) and 2 (*b*).—Cooke Flat-Field Objective, 6 mm., 0·8 N.A., and special negative projection lens.

Fig. 1.—0·01-mm. Scale on Metal. Fig. 2.—Water-Quenched Aluminium Bronze.
Reduced by approx. $\frac{1}{5}$ in reproduction.

same value, corresponding to about 7½% chromium, according to the lattice-parameter/composition data of Jette and his co-workers.[1] Sully,[7] however, showed that there was a considerable concentration gradient across the diameter of a nickel–chromium alloy wire after heating in air. The lattice-parameter measurements must, therefore, be taken to refer to the surface layers of the metal, but not necessarily to the interior, where the chromium content may be higher. The agreement obtained in the present instance is, in spite of these conditions and the empirical nature of the test itself, gratifying, and the method may prove to be of technical use or of value with other types of alloy.

The authors thank Mr. F. H. Saniter, Director of Research, The United Steel Companies, Ltd., for granting permission to publish this information.

W. C. Heselwood
K. W. Andrews

The United Steel Companies, Ltd.,
Research and Development Department,
Rotherham.

REFERENCES

1. E. R. Jette, V. H. Nordstrom, B. Queneau, and F. Foote, *Trans. Amer. Inst. Min. Met. Eng.*, 1934, **111**, 361.
2. L. Horn, *Z. Metallkunde*, 1944, **36**, 142.
3. G. Tammann, *Z. anorg. Chem.*, 1920, **111**, 83.
4. N. B. Pilling and R. E. Bedworth, *J. Inst. Metals*, 1923, **29**, 529.
5. U. R. Evans, "Review of Oxidation and Scaling of Heated Solid Metals", p. 1. **1935**: London (H.M. Stationery Office).
6. F. E. Bash and J. W. Harsch, *Proc. Amer. Soc. Test. Mat.*, 1929, **29**, (II), 506.
7. A. H. Sully, *J. Sci. Instruments*, 1945, **22**, 244.

A New Flat-Field Microscope Objective for the Metallurgist

In the high-power microscope objective high resolution and contrast in the axial image are of primary importance and have usually been obtained at the price of noticeable curvature at the edge of the field of view. This may occasion considerable inconvenience, especially in photomicrography, where the need often arises for an objective of high N.A. which will cover a large flat field at a relatively low magnification without sacrificing central definition should subsequent enlargement become necessary.

Several methods have been explored for flattening the image field, all of them having as their aim the introduction of negative Petzval curvature to counteract the excessive positive curvature of the conventional objective. This has been achieved by incorporating a triplet lens system similar to a Taylor photographic anastigmat between the objective proper and the image plane and also by employing a reversed Taylor triplet (with two negative components and one positive) in the same position. More recently it has been found that it is possible to incorporate surfaces having powerful negative curvature in the front components of the objective, thereby introducing considerable field flattening without the excessive length and complexity associated with the older systems.

A new flat-field objective has now been developed which employs as its second lens a thick meniscus which in itself has almost sufficient Petzval curvature to balance that of the other components. The objective has a focal length of 6 mm. and an N.A. of 0·80 and is intended primarily for use on the Vickers Projection Microscope. It provides a larger field of view than can be accommodated by ordinary low-power eyepieces, and must therefore be used in conjunction with a special 8× projection eyepiece. At high powers and for visual work, however, compensating eyepieces can be employed.

The advantages of such an objective can be gauged from the two pairs of photomicrographs (Figs. 1 and 2), which afford a direct comparison between the new objective and a 4-mm. achromat of conventional design.

It is evident that the extended field has not been obtained at the expense of axial definition and contrast, and any part can if desired be enlarged almost up to the physical limit of resolving power.

All the photomicrographs were taken on a Vickers Projection Microscope, using normal incident illumination and a Pointolite lamp, with the bellows extension set at 40 cm. for Figs. 1 (*a*) and 2 (*a*), and 47 cm. for Figs. 1 (*b*) and 2 (*b*), to give a magnification of 385 × throughout.

B. O. Payne

Cooke, Troughton, and Simms, Ltd.,
York.

NEWS OF LOCAL SECTIONS AND ASSOCIATED SOCIETIES

London Local Section

At the first meeting of the session, held on 1 October at 4 Grosvenor Gardens, London, S.W.1, Mr. A. D. Le Claire, of the Atomic Energy Research Establishment, Harwell, gave a lecture on:

Intermetallic Diffusion

The lecturer said that his aim was to demonstrate that the interdiffusion coefficient between two metals, as normally measured, for example, by the Matano method, was not a simple and irreducible constant, but was determined by a number of physically distinguishable and individually measurable quantities. This was best made clear by considering in turn increasingly complex cases of diffusion. The simplest case was that of self-diffusion in a pure metal. Fick's law of diffusion was readily derived from simple kinetic consideration of the rate of flow of radioactive atoms in a radioactive concentration gradient, and the self-diffusion coefficient obtained in terms of the lattice spacing a and the average number of random jumps n made per second by each atom. ($D = a^2n/2$). Methods of measuring self-diffusion coefficients were briefly described, and the principal results of such measurements discussed. Self-diffusion of each component in a homogeneous alloy represented the next most complex case, measurements of which led to the important result that, at least for the close-packed alloys, the separate self-diffusion coefficients of the two alloy constituents were *not* equal, and that each varied with temperature and composition in its own way. These results had an important bearing on deciding between the various possible atomic mechanisms of diffusion; an account was given of this and other evidence which strongly indicated that for most metals and alloys diffusion occurred through the agency of vacant lattice sites (vacancies). Finally, the practically most important case of diffusion down a chemical concentration gradient was discussed. Whereas in self-diffusion each atom was as likely to jump in one direction as another, this was not the case in a chemical gradient because in general the energy of an alloy varied with the composition and diffusing atoms experienced a tendency to jump more often in such a direction as to lower the energy, than in the other direction. As a result of this each of the two chemical diffusion coefficients depended not only on a and n, but now

included an additional term—the " thermodynamic factor "—and so were not equal to the corresponding self-diffusion coefficients as measured in a homogeneous alloy. The observed rate of interdiffusion between two dissimilar metals, as expressed by the single diffusion coefficient measured in conventional diffusion experiments, depended on the values of these two separate chemical diffusion coefficients, each of which varied with composition and with temperature to different extents. That these were unequal led to microscopic changes in the geometry of diffusion samples, such as a movement of the original interface (the Kirkendall effect), and an expansion and shrinkage on opposite sides of the interface in directions normal to the diffusion direction, produced by the opposite and unequal rates of flow of the two components. Very frequently, too, porosity developed on that side of the sample from which there was a net loss of atoms, because of the failure of the material to accommodate the changes produced by these unequal flows. These phenomena were briefly discussed in terms of the vacancy mechanism of diffusion, as also was the influence they might have on measurements of the interdiffusion coefficient.

South Wales Local Section

On 3 November a lecture was given by Professor DAVID WILLIAMS on :

The Search for Metalliferous Mineral Deposits

Professor Williams said that the discovery of mineral deposits had heralded the industrial awakening of many sparsely inhabited regions of the world. Although it was becoming increasingly difficult to replenish the wasting reserves of essential minerals required by industry, it was certain that vast deposits still awaited discovery beneath a concealing blanket of barren rock, soil, or forest.

As guides in the search for ore, the geologist now used air photographs, and sought to interpret the oxidized cappings of veins, the mineralogical changes in rocks alongside lodes, and the stratigraphical and structural controls of ore deposition. Geophysical prospecting, including magnetic, electrical, gravimetric, and radiometric methods, helped him to elucidate physical differences in the rocks of an area which might be related to hidden ore. The newest method of exploration, that of geochemical prospecting, might reveal the presence of a valuable buried deposit by detecting abnormal amounts of trace metals dispersed in the rocks and soils surrounding an ore body, in the plants and trees growing on these soils, or in the waters and sediments of streams draining the mineralized area. Geophysical and geochemical methods of prospecting promised to play a vital role in aiding the geologist in the future search for metalliferous mineral deposits.

Dr. IVOR JENKINS, of the Research Laboratories of the General Electric Co., Ltd., on 1 December gave a lecture on :

Metallurgical Research in the Electrical Engineering Industry

He said that the scope of the electrical engineering industry was extremely broad and the nature of the metallurgical problems which arose could be extremely diverse in character, ranging on the one hand from those associated with materials for prime movers, heavy electrical machinery, and illuminating engineering to those relating to radio and electronic components on the other. It was convenient to consider the problems which arose under general headings.

Firstly, the industry was extremely interested in the effect of impurities on the properties of metals in general. This was especially important in materials for electrical and magnetic purposes; in materials for effecting satisfactory seals with glass; and in the use of materials at elevated temperatures where the effects of trace impurities could have a marked effect on the adherence of oxide. More recently, the use of silicon and germanium for rectification purposes had thrown emphasis upon the need for control of impurities at an extremely low level.

Secondly, grain growth and crystal stability of metals were of importance in lamp filaments and in materials used for certain of the electrodes in valves. Here methods of controlling grain-size and grain-boundary characteristics had to be considered and, in particular, means of producing a stable polycrystalline material in fine wires which might be as small as 10 microns in dia. This problem was not unrelated to that of the selection of alloys for the stressed parts of turbines, where the effect of structural characteristics and resistance to creep and fatigue were of great importance.

Finally, gas–metal systems were of importance throughout almost the whole range of electrical engineering products. In vacuum devices, freedom from gases was an essential requirement for the metals used; in others, operating under specific atmosphere conditions, the prevention of clean-up of the atmosphere by the metal system was most desirable. In this respect the surface activity of the metals used in relation to adsorption and desorption of gas was assuming ever-greater importance.

NEWS OF KINDRED SOCIETIES

Associazione Italiana di Metallurgia : Award of Guido Donegani Medal

The presentation of the first Guido Donegani gold medal for light alloy metallurgy was made in Milan on 11 October to Professor ALFRED VON ZEERLEDER, Director of the Research Laboratories of Aluminium Industrie A.G., Neuhausen.

The medal is to be awarded every two years to a scientist, Italian or foreign, who has made outstanding contributions to knowledge of aluminium, its metallurgy and technology.

Professor von Zeerleder is Honorary Corresponding Member to the Council of the Institute of Metals for Switzerland, and is to deliver the Autumn Lecture during the meeting in Zürich next September.

OTHER NEWS

British Iron and Steel Research Association : Opening of New Laboratories

New laboratories of the British Iron and Steel Research Association at Sheffield were opened on 19 November by H.R.H. The Duke of Edinburgh, K.G., in the presence of a large and distinguished gathering.

These laboratories will house the Steelmaking, Mechanical Working, and Metallurgy Divisions of the Association, other activities being carried on in laboratories elsewhere. On a two and a half acre site in Hoyle Street, three buildings have been erected and equipped at an approximate cost of half a million pounds. They are, respectively, a three-storey main laboratory and office block, a metal-working shop, and a melting shop.

After the opening ceremony at midday, visitors were able to make a detailed inspection of the laboratories. Among the

larger items of equipment to be seen were a high-speed reversible four-high cold strip mill; a small two-high mill formerly in use at the Cavendish Laboratory, Cambridge; a cam plastometer for compression testing, also formerly in use at Cambridge; a vertical hydraulic press of 200 tons' capacity; a two-hole straight-line wire-drawing machine, having a maximum finishing speed of 5000 ft./min.; an H.F. high-vacuum melting and casting set capable of dealing with 55 lb. of iron; and a 10-cwt. electric arc melting furnace. Displays of work in progress at this and other B.I.S.R.A. laboratories were on view in the main block.

DIARY

Local Sections and Associated Societies

18 January. Scottish Local Section. Visit to the Research Laboratories of Babcock and Wilcox, Ltd., Renfrew.

20 January. Manchester Metallurgical Society. "Equilibrium Diagrams", by Professor G. V. Raynor. (Lecture Room, The Central Library, Manchester, at 6.30 p.m.)

21 January. Birmingham Local Section. "The Philosophy of Science", by Professor S. Toulmin. (The Imperial Hotel, Temple Street, Birmingham, at 6.30 p.m.)

22 January. North East Metallurgical Society. "Evolution in Extraction Metallurgy", by Professor C. W. Dannatt. (King's College, Newcastle-upon-Tyne, at 7.15 p.m.)

2 February. Oxford Local Section. Junior Members' Evening. Discussion on New Topics. (The Oak Room, Cadena Café, Cornmarket Street, Oxford, at 7.0 p.m.)

3 February. Manchester Metallurgical Society. "Solidification in Castings", by R. W. Ruddle. (Lecture Room, The Central Library, Manchester, at 6.30 p.m.)

4 February. Birmingham Local Section. "The Fracture of Steel", by J. E. Russell. (James Watt Memorial Institute, Great Charles Street, Birmingham, at 6.30 p.m.)

4 February. Leeds Metallurgical Society. "Nucleation in Metals and Alloys", by J. H. O. Varley. (Chemistry Department, The University, Leeds 2, at 7.15 p.m.)

4 February. London Local Section. "Germanium and Silicon", by R. W. Douglas. (4 Grosvenor Gardens, London, S.W.1, at 6.30 p.m.)

8 February. North East Metallurgical Society. "Protection of Steelwork from Atmospheric Corrosion", by Dr. F. R. Himsworth. (Cleveland Scientific and Technical Institution, Middlesbrough, at 7.15 p.m.)

8 February. Scottish Local Section. "Some Practical Hints on the Production of Non-Ferrous Castings", by William Dunlop. (Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.)

9 February. South Wales Local Section. "The Zinc Die-Casting Alloys", by L. A. J. Lodder. (University College, Metallurgy Department, Singleton Park, Swansea, at 6.45 p.m.)

11 February. Liverpool Metallurgical Society. "Diffusion in Metals", by A. D. Le Claire. (Liverpool Engineering Society, The Temple, Dale Street, Liverpool, at 7.0 p.m.)

Other Societies

18 January. Sheffield Society of Engineers and Metallurgists. Presidential Address. (University Building, St. George's Square, Sheffield, at 7.30 p.m.)

19 January. Institute of British Foundrymen, East Anglian Section. "Metallizing in Relation to Foundry Practice", by J. Barrington Stiles. (Central Hall, Public Library, Ipswich, at 7.30 p.m.)

19 January. Institute of British Foundrymen, Slough Section. "Centrifugal Castings", by M. M. Hallett. (Lecture Theatre, High Duty Alloys, Ltd., Slough, at 7.30 p.m.)

19 January. Sheffield Metallurgical Association. Résumé of Papers presented at the 6th Chemists' Conference (Ashorne Hill), 1953. (B.I.S.R.A., Hoyle Street, Sheffield, at 7.0 p.m.)

19 January. Society of Chemical Industry, Birmingham and Midland Section. "Titanium", by Dr. N. P. Inglis. (Birmingham and Midland Institute, Paradise Street, Birmingham 1, at 6.30 p.m.)

20 January. Society of Chemical Industry, Corrosion Group. "Metallurgical Aspects of Dry Corrosion", by Dr. L. B. Pfeil. (Chemical Society, Burlington House, Piccadilly, London, W.1, at 6.30 p.m.)

20 January. Society of Chemical Industry, Liverpool Section. "The Manufacture, Properties, and Uses of Titanium", by E. Stables. (College of Further Education, Widnes, at 7.0 p.m.)

21 January. Institution of Mining and Metallurgy. General Meeting. (Rooms of the Geological Society, Burlington House, Piccadilly, London, W.1., at 5.0 p.m.)

21 January. Society of Chemical Industry, Corrosion Group. Exhibition and Conversazione. (Battersea Polytechnic, Battersea Park Road, London, S.W.11, at 6.30 p.m.)

26 January. Royal Aeronautical Society. Section Lecture: "X-Ray Metallography", by Dr. G. L. J. Bailey. (Library, 4 Hamilton Place, London, W.1, at 7.0 p.m.)

26 January. Sheffield Metallurgical Association. Annual General Meeting and Presidential Address by F. H. Saniter. (B.I.S.R.A., Hoyle Street, Sheffield, at 7.0 p.m.)

28 January. Institute of British Foundrymen, Southampton Section. "General Foundry Problems", by G. J. Rogers. (Southampton Technical College, St. Mary Street, Southampton, at 7.0 p.m.)

1 February. Institute of British Foundrymen, Sheffield and District Branch. "Modern Methods of Pattern Making, with Special Reference to American Practice and Pressure-Cast Aluminium Pattern Plates", by B. N. S. Perry. (Sheffield College of Commerce and Technology, Pond Street, Sheffield 1, at 7.30 p.m.)

2 February. East Midlands Metallurgical Society. Members' Night. Short papers to be given by Society Members. (Nottingham and District Technical College, Shakespeare Street, Nottingham, at 7.30 p.m.)

8 February. Institute of Welding, Sheffield and District Branch. "Developments in Welding Research", by Dr. A. A. Wells. (Sheffield College of Commerce and Technology, Pond Street, Sheffield 1, at 7.15 p.m.)

9 February. Society of Chemical Industry, Chemical Engineering Group. "Non-Ferrous Metals for the Chemical Engineer", by Dr. N. P. Inglis. (Geological Society, Burlington House, London, W.1, at 5.30 p.m.)

APPOINTMENTS VACANT

ADAPTABLE YOUNG MAN, aged 20–24, with metallurgical education for position with excellent prospects in heat-treatment dept. of expanding company in the Midlands. Full details to Box No. 358, Institute of Metals, 4 Grosvenor Gardens, London, S.W.1.

GRADUATE METALLURGIST with experience of light alloys, welding, and corrosion problems in the aircraft industry required by The English Electric Co., Ltd., Luton. Applications to Dept. C.P.S., 336/7 Strand, London, W.C.2, quoting ref. 1112A.

LEAD WORKS in North West desire to engage a Production/Works Manager. Small staff, but substantial tonnage of sheet and pipe involved. Must be keen. Suitable for man 25–35. Please state age, experience, and an indication of salary range in full confidence to Box No. 359, Institute of Metals, 4 Grosvenor Gardens, London, S.W.1.

TECHNICAL ASSISTANT required in the library of an international research organization. Candidates must be graduates, or equivalent, in metallurgy, chemistry, physics, or engineering. Experience in special library or information work and knowledge of French or German is desirable. Commencing salary would depend on qualifications and previous experience. Apply to: The Director, Aluminium Laboratories Limited, Banbury, Oxon.

THE MOND NICKEL COMPANY invites applications from ENGINEERS and METALLURGISTS for a post in Johannesburg in connection with the technical development of nickel-containing materials in South Africa and the Rhodesias. Applicants should have a University degree or equivalent and industrial experience in the uses of ferrous and non-ferrous materials. Candidate appointed would be eligible for membership of the Company's non-contributory pension scheme. Apply stating age, qualifications, and salary required, to Manager, Development and Research Department, The Mond Nickel Co., Ltd., Sunderland House, Curzon Street, London, W.1. Mark envelope "Confidential D.26".

YOUNG GRADUATE in chemistry, physics, or metallurgy required by the Nelson Research Laboratories, The English Electric Co., Ltd., Stafford, for work in X-ray crystallography. Previous experience is desirable but not essential. Facilities for training are available. Write, quoting ref. 1212, to Dept. C.P.S., 336/7 Strand, London, W.C.2.

THE CONTROL OF QUALITY IN MELTING AND CASTING

THE CONTROL OF QUALITY IN THE PRODUCTION OF WROUGHT NON-FERROUS METALS AND ALLOYS—I.

Cloth. 4to. 88 pages, with 14 plates and numerous illustrations in the text.
Price 15s. or $2.50, post free; Members one copy at 7s. 6d. or $1.50, post free.

CONTENTS

The Principles of Technical Control in Metallurgical Manufacture.
By A. R. E. Singer, B.Sc., Ph.D. (*University of Birmingham*)

The Control of Quality in the Production of Brass Ingots and Billets.
By Maurice Cook, D.Sc., Ph.D., F.I.M. and C. L. M. Cowley, B.Sc., A.I.M. (*Imperial Chemical Industries, Ltd., Metals Division*)

The Control of Quality in Melting and Casting Copper and High-Conductivity Copper-Base Alloys.
By J. Sykes, F.I.M. (*Enfield Copper Refining Co., Ltd.*)

The Control of Quality in the Casting of Zinc and Zinc Alloy Rolling Slabs and Extrusion Billets.
By C. W. Roberts, B.Sc., A.I.M. and B. Walters, M.A. (*Imperial Smelting Corporation, Ltd.*)

The Control of Quality in the Melting and Casting of Aluminium Alloys for Working.
By R. T. Staples and H. J. Hurst (*T. I. Aluminium, Ltd.*)

The Control of Quality in Melting and Casting Magnesium Alloys for Hot Working.
By R. G. Wilkinson, B.Sc. and S. B. Hirst, B.Sc.Tech. (*Magnesium Elektron, Ltd.*)

General Discussion and Indexes.

INSTITUTE OF METALS · 4 Grosvenor Gardens, London, S.W.1